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A Unified Experimental Approach for Estimation of Irrigation Water and Nitrate leaching in Tree Crops

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Groundwater quality is specifically vulnerable in irrigated agricultural lands in California and many other (semi-)arid regions of the world. The routine application of nitrogen fertilizers with irrigation water in California is likely responsible for the high nitrate concentrations in groundwater, underlying much of its main agricultural areas. To optimize irrigation/fertigation practices, it is essential that irrigation and fertilizers are applied at the optimal concentration, place, and time to ensure maximum root uptake and minimize leaching losses to the groundwater.

The applied irrigation water and dissolved fertilizer, as well as root growth and associated nitrate and water uptake, interact with soil properties and fertilizer source(s) in a complex manner that cannot easily be resolved. It is therefore that coupled experimental-modeling studies are required to allow for unraveling of the relevant complexities that result from typical field-wide spatial variations of soil texture and layering across farmer-managed fields. We present experimental approaches across a network of tree crop orchards in the San Joaquin Valley, that provide the necessary soil data of soil moisture, water potential and nitrate concentration to evaluate and optimize irrigation water management practices. Specifically, deep tensiometers were used to monitor in-situ continuous soil water potential gradients, for the purpose to compute leaching fluxes of water and nitrate at both the individual tree and field scale.